

TECHNICAL MANUAL

**UNIT, DIRECT SUPPORT, AND GENERAL SUPPORT
MAINTENANCE MANUAL**

**(INCLUDING REPAIR PARTS AND
SPECIAL TOOLS LIST)**

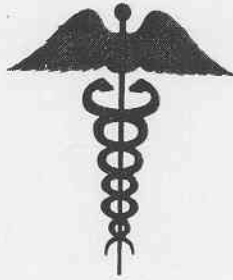
**THERMOMETER, CLINICAL, HUMAN,
ELECTRICAL, MODEL 600**

6515-01-313-6242

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HEADQUARTERS, DEPARTMENT OF THE ARMY

January 1999



SAFETY STEPS TO FOLLOW IF SOMEONE IS THE VICTIM OF ELECTRICAL SHOCK

Do not try to pull or grab the individual.

If possible, turn off the electrical power.

If you cannot turn off the electrical power, pull, push, or lift the person to safety using a dry wooden pole or a dry rope, or some other insulating material.

Send for help as soon as possible.

After the injured person is free of contact with the source of electrical shock, move the person a short distance away and immediately start artificial resuscitation.

Throughout this manual are WARNINGS, CAUTIONS, and NOTES. Please take time to read these. They are there to protect you and the equipment.

WARNING

Procedures which must be observed to avoid personal injury, and even loss of life.

CAUTION

Procedures which must be observed to avoid damage to equipment, destruction of equipment, or long-term health hazards.

NOTE

Essential information that should be remembered.

TECHNICAL MANUAL

HEADQUARTERS

WASHINGTON, DC

NO. 8-6515-012-14&P

UNIT, DIRECT SUPPORT, AND GENERAL SUPPORT
 MAINTENANCE MANUAL
 (INCLUDING REPAIR PARTS AND SPECIAL TOOLS LIST)
 THERMOMETER, CLINICAL, HUMAN, ELECTRICAL, MODEL 600
 6515-01-313-6242

You can help improve this manual. If you find any mistakes or if you know a way to improve procedures, please let us know. Mail your memorandum, DA Form 2028 (Recommended Changes to Publications and Blank Forms), or DA Form 2028-2 (Recommended Changes to Equipment Technical Publications) located in the back of this manual, to: Commander, U.S. Army Medical Materiel Agency, ATTN: SGMMA-M, Frederick, MD 21702-5001. A reply will be furnished directly to you.

Approved for public release; distribution is unlimited.

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HOW TO USE THIS MANUAL

This manual provides all the information needed to understand the capabilities, functions, and characteristics of this equipment. It describes how to set up, operate, test, and repair the equipment. You must familiarize yourself with the entire manual before operating or beginning a maintenance task.

The manual is arranged by chapter, section, and paragraphs followed by appendixes, a glossary, an index, and DA Forms 2028-2. Use the table of contents to help locate the chapter or section for the general subject area needed. The index will help locate more specific subjects.

Multiple figures and tables are provided for your ease in using this manual. Words that are both capitalized and in quotation marks are names of components or words that you will actually see on the equipment.

Chapter 3 provides a systematic method of inspecting and servicing the equipment. In this way, small defects can be detected early before they become a major problem causing the equipment to fail. Make a habit of doing the checks and services in the same order each time and anything wrong will be detected quickly.

Only perform maintenance functions specified in the maintenance allocation chart for your level of maintenance. Maintenance functions specified for higher levels of maintenance frequently require additional training; test, measurement, and diagnostic equipment; or tools.

CHAPTER 1

INTRODUCTION

Section I. GENERAL INFORMATION

1-1. Overview.

This manual describes the thermometer (fig 1-1); provides equipment technical data; and provides operational and maintenance functions, services, and actions. Additional information follows:

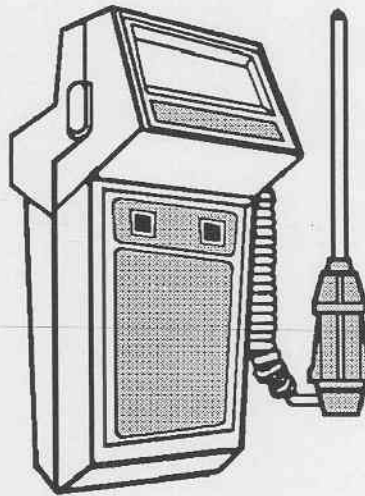


Figure 1-1. Thermometer.

- a. *Type of manual.* Unit, direct support (DS), and general support (GS) maintenance (including repair parts and special tools list).
- b. *Model number and equipment name.* Model 600, Thermometer, Clinical, Human, Electrical.
- c. *Purpose of equipment.* To measure patient temperatures 84°F (28.9°C) to 108°F (42.2°C).

1-2. Explanation of abbreviations and terms.

Special or unique abbreviations, acronyms, and terms used in this manual are explained in the glossary.

1-3. Maintenance forms, records, and reports.

TB 38-750-2 prescribes forms, records, reports, and procedures.

1-4. Destruction of Army materiel to prevent enemy use.

AR 40-61 contains instructions for destruction and disposal of Army medical materiel. Also, the SB 8-75 series publications provide periodic information and/or instructions on the disposal of medical materiel that are hazardous.

1-5. Administrative storage.

a. Place the thermometer in administrative storage for only short periods of time when a shortage of maintenance effort exists. This equipment should be in mission readiness condition within 24 hours or within the time factors determined by the directing authority. During the storage period, keep appropriate maintenance records.

b. Perform preventive maintenance checks and services (PMCS) listed in the operator PMCS table and the repairer PMCS table before placing Army equipment in administrative storage. When equipment is removed from storage, perform PMCS to ensure its operational readiness.

c. Inside storage is preferred for equipment selected for administrative storage.

1-6. Preparation for storage or shipment.

Procedures to prepare the thermometer for storing or shipping are listed in chapter 3, section X.

1-7. Quality control (QC).

TB 740-10/DLAM 4155.5/AFR 67-43 contains QC requirements and procedures.

1-8. Nomenclature cross-reference list.

Table 1-1 identifies official versus commonly used nomenclatures.

Table 1-1. Nomenclature cross-reference list.

<i>Common name</i>	<i>Official nomenclature</i>
Display	Digital temperature display
On/off switch	Automatic on/off switch (probe switch)
Mode switch	C/F mode switch
Mode switch	Normal/monitor mode switch
Timer	Timer switch
Thermometer	Thermometer, clinical, human, electrical

1-9. Reporting and processing medical materiel complaints and/or quality improvement reports.

AR 40-61 prescribes procedures for submitting medical materiel complaints and/or quality improvement reports for the thermometer.

1-10. Warranty information.

A warranty is not applicable.

Section II. EQUIPMENT DESCRIPTION AND DATA

1-11. Equipment characteristics, capabilities, and features.

The digital thermometer is a portable instrument for measuring patient temperatures over the 84°F (28.9°C) to 108°F (42.2°C) range. It features a liquid crystal display (LCD) readout with backlight, interchangeable probes, disposable probe covers, disposable batteries with a capacity for up to 45,000 temperatures, automatic power shutdown, both normal and monitor modes of operation, and self calibration/test capability.

1-12. Component and accessory descriptions (fig 1-2 and fig 1-3).

a. *Hand-held digital monitor.* The monitor contains two custom integrated circuits which provide the microprocessor and analog circuit functions. The monitor has a switch for Fahrenheit/Celsius selection. It also has a switch for normal/monitor selection. There is a switch for selecting the backlight. There is an LCD screen for direct readout.

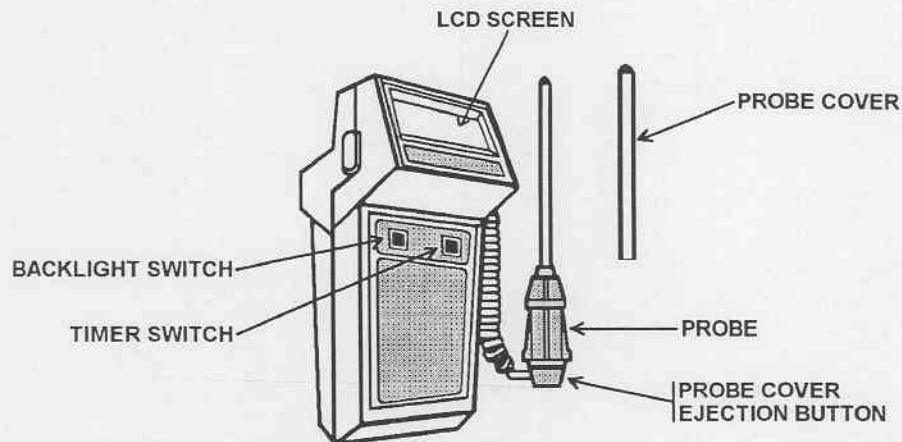


Figure 1-2. Thermometer components.

b. *Probe with connector.* The probe along with the patient probe cover is used for direct contact with the patient for temperature tests.

c. *Carrying strap.* The carrying strap is used around the neck for carrying the instrument.

d. *Probe protective covers.* Probe protective covers are used to protect the patient from contagious diseases. A new cover is used for each new patient.

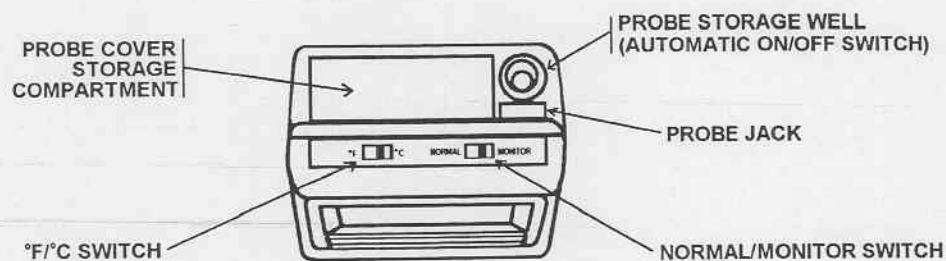


Figure 1-3. Top view.

1-13. Tabulated data, decals and data plates.

a. *Specifications and miscellaneous characteristics.* Tables 1-2 and 1-3 provide a broad range of specifications and miscellaneous characteristics to include battery capacity and a list of visual and audible indicators.

Table 1-2. Specifications.

Battery capacity.....	3 disposable AA cells with up to 1000 hrs continuous use
Range.....	84.0°F (28.9°C) to 108.0°F (42.2°C)
Accuracy.....	±0.2°F (±0.1°C)
Visual and audible indicators	
Digital temperature display	
30-second pulse and respiration timer	
Instrument malfunction	
Broken probe	
Probe position	
Low battery	
Out of range temperature	

Table 1-3. Miscellaneous characteristics.

Dimensions	
Height	61mm (2.4 in)
Width	94mm (3.7 in)
Length	159mm (6.25 in)
Weight	298 grams (10.5 oz)
Duty cycle	Continuous
Humidity	90% maximum

b. Identification, instruction, and warning plates, decals, or markings.

- (1) The thermometer manufacturer data plate (located in the upper rear housing) is depicted in figure 1-4.
- (2) A decal (located on the lower front side) providing operating instructions is depicted in figure 1-5.

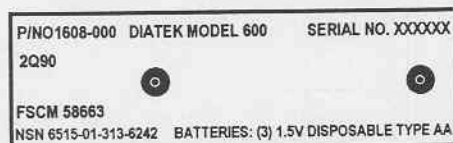


Figure 1-4. Manufacturer data plate.



Figure 1-5. Operating instructions decal.

1-14. Model differences.

Model differences are not applicable since this manual covers a single model.

1-15. Safety, care, and handling.

- a. Observe each WARNING, CAUTION, and NOTE in this manual.
- b. Read the operating instructions in this manual before operating the unit. Refer servicing to qualified Medical Equipment Repairer personnel.

Section III. PRINCIPLES OF OPERATION

1-16. Basic operation.

- a. The thermometer is comprised of two custom integrated circuits which provide the microprocessor and analog circuit functions. All control and display functions are governed by the microprocessor (U2) and all analog interfacing to the microprocessor, probe, horn, and backlight is provided by U1. Probe resistance measurements are made by ratioing pulse widths generated by sequentially switching in two calibration resistors and the probe thermistor. These pulse widths are measured by the microprocessor which calculates the probe resistance. The actual probe temperature is then calculated from the probe resistance.
- b. During monitor mode operation, the actual temperature appears directly on the LCD which is driven by the integral LCD driver on the microprocessor.
- c. During normal mode operation, the shape of the rising temperature curve is monitored and a continuously computed correction factor is added to the actual probe temperature. The normal mode temperature cycle is terminated when the predicted temperature remains stable.

CHAPTER 2

OPERATING INFORMATION AND INSTRUCTIONS

Section I. PREPARATION FOR OPERATION

2-1. Scope.

This manual is primarily intended to provide information, instructions, and procedures for the maintenance of the thermometer system. The operating information and instructions, while valid, do not provide sufficient information for use of the thermometer system on a patient. Only qualified medical personnel are trained in specific temperature taking techniques and procedures.

2-2. Assembly.

The thermometer apparatus may or may not require assembly dependent upon the standard operating procedures of your unit. If required, assembly procedures are as follows:

- a. Unpack the thermometer system. Check for any damage that may have occurred during shipping.
- b. Select the desired probe. The oral probe is green with a blue end cap. The rectal probe is red with a white end cap.
- c. Insert the connector plug in the probe receptacle. Check that the connection is secure.

2-3. Setup.

- a. Observe the 6-second display test, ensuring that no display segments are missing (fig 2-1).
- b. Insert the probe shaft into the probe storage well (fig 2-2).
- c. Remove the tab from a box of 25 disposable probe covers and insert the box into the storage compartment on the thermometer.

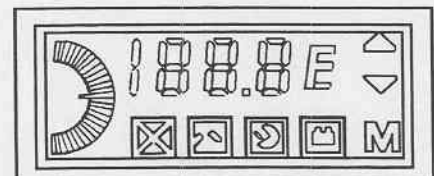


Figure 2-1. Display test.

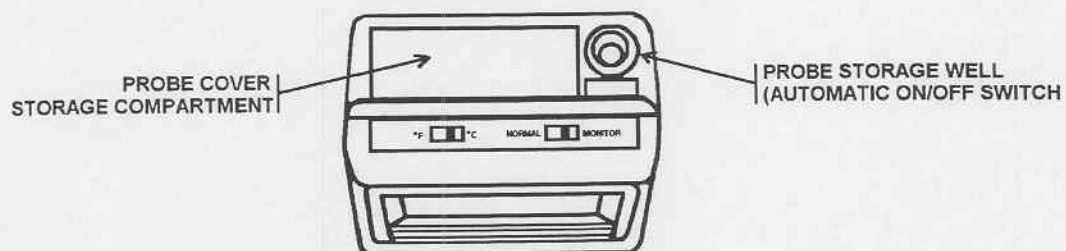


Figure 2-2. Probe storage well.

Section II. OPERATING INFORMATION

2-4. Controls and indicators (fig 2-3 and fig 2-4).

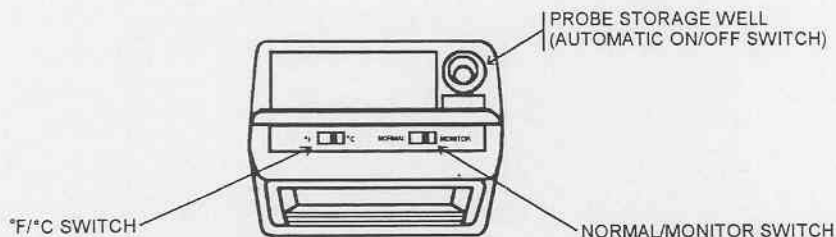


Figure 2-3. Thermometer controls.

a. *On/off switch.* Removal of the probe from the probe well automatically turns the unit on.

b. *Normal/monitor switch.*

(1) *Normal mode.* A continuously increasing temperature should be observed on the display. When the final temperature has been reached, a tone will sound.

(2) *Monitor mode.* When using the monitor mode, the temperature readout will stabilize after 3 minutes. The patient can be continuously monitored for as long as necessary.

c. *F°/C° mode switch.* The display may be changed between Fahrenheit and Celsius at any time prior to, during, or after taking a temperature by activating the F°/C° slide switch.

d. *Backlight switch.* This switch activates a light that is used to read the display in poorly lit areas. The light is activated as long as the backlight switch is pressed and the thermometer function is active.

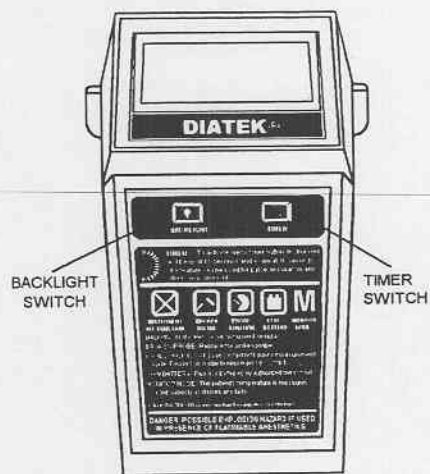


Figure 2-4. Backlight and timer switches.

NOTE

The backlight is not visible in well lit areas.

e. *Timer switch.* Pressing the pulse timer switch at any time causes the 30-second clock type display to start. It is used to determine a patient's pulse, respiration, IV drip rate or any other timed measurement. An audible alarm sounds at 15 seconds and again at 30 seconds.

Section III. OPERATING INSTRUCTIONS

2-5. Initial start-up procedures.

- a. Place the carrying strap around your neck with the instrument display facing you.
- b. Select the temperature scale (either Fahrenheit or Celsius) and the temperature measurement mode (either normal or monitor).
- c. Withdraw the probe from the storage well and observe the display test. The unit will then display 84°F (28.9°C) with the low temperature arrow on until the temperature rises above 84°F.

2-6. Routine start-up procedures.

Daily routine start-up procedures will follow the initial start-up procedures except for differences involving actual clinical tests.

2-7. Operating procedures.

- a. Load a probe cover onto the probe. Hold the probe collar with your thumb and forefinger. Press the collar down firmly to secure the cover.

- b. Take the patient's temperature.

(1) *Oral temperatures.* Using the green probe, insert the probe tip gently into the patient's slightly opened mouth. Carefully slide the probe under the tongue on either side of the mouth to reach the sublingual pocket.

(2) *Rectal temperatures.* Using the red probe, gently insert the probe only 3/4 in (1 cm) inside the rectal sphincter (less for infants and children). Tilt the probe to ensure good tissue contact and continue to keep the buttocks separated until measurement cycle is complete.

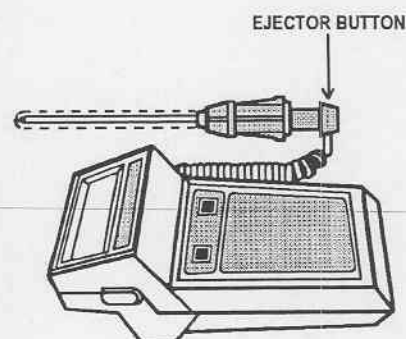


Figure 2-5. Probe.

WARNING

Incorrect insertion of the probe into the rectum can cause bowel perforation.

- c. During a temperature measurement cycle in the normal mode, a continuously increasing temperature should be observed on the display. When the final temperature has been reached, a tone will sound and a °F or °C temperature will be displayed. When using the monitor mode, allow the temperature readout to stabilize for 3 minutes. The patient may then be continuously monitored for as long as necessary.

- d. After the temperature measurement is complete, eject the probe cover by firmly pressing the eject button on the top of the probe (fig 2-5).

2-8. Shut-down procedures.

- a. Insert the probe into the storage well to clear the display. The unit will shut off in preparation for another temperature test.

- b. Refer to this chapter, section V, for cleaning and sterilizing procedures.

Section IV. OPERATION OF AUXILIARY EQUIPMENT

2-9. Associated support items of equipment.

The thermometer requires no associated support items of equipment other than batteries for electrical power.

2-10. Associated material.

Associated material is identified in appendix D and appendix E.

Section V. CLEANING AND STERILIZING PROCEDURES

2-11. General.

a. The thermometer unit and operating accessories should be clean at all times. Specific cleaning and sterilizing procedures are provided in subsequent paragraphs.

b. Accessories identified as disposable should not be cleaned or reused. These accessories were designed and manufactured for one use only.

c. Follow your unit's standard operating procedures for the use of personal protective equipment when cleaning the thermometer. Personal protective equipment may include goggles, mask, gloves, and gown or other suitable clothing.

2-12. Thermometer.

a. *Cleaning.* The thermometer unit and probes should be cleaned periodically by wiping it with an alcohol soaked cloth or pad, warm water, or non-staining disinfectant.

CAUTION

Do not autoclave or immerse the thermometer unit.

b. *Sterilizing.* Under conditions where an alcohol wipe or germicidal wipe is inadequate, the unit may be sterilized in ethylene oxide (ETO). This is to be done at no more than 100°F and 85% humidity. It is emphasized that this procedure is to be used only when absolutely necessary.

CAUTION

Batteries must be removed from the thermometer unit before ETO sterilization.

Section VI. OPERATION UNDER UNUSUAL CONDITIONS

2-13. Unusual conditions.

The thermometer is designed to operate only within a medical treatment facility.

CHAPTER 3

UNIT LEVEL MAINTENANCE

Section I. GENERAL INFORMATION

3-1. Overview.

a. Unit level maintenance. This level of maintenance is the responsibility of and performed by a using unit on its assigned equipment. Responsibilities are stratified as follows:

(1) *Operator maintenance.* This segment of unit level maintenance is performed by operator/user personnel and consists of equipment operational functions; routine services like cleaning, dusting, washing, checking for frayed cables, and stowing items not in use; and checking for loose hardware, replacing operator accessories, and replacing operator repair parts. Replacing operator parts will not require extensive disassembly or reassembly of the end item, critical adjustments after replacement, or the extensive use of tools.

(2) *Specialist maintenance.* This segment of unit level maintenance is performed only by trained Medical Equipment Repairers. The functions and services include—

(a) Scheduling and performing PMCS, electrical safety inspections and tests, and calibration/verification/certification (CVC) services.

(b) Performing unscheduled maintenance functions with emphasis on replacing assemblies, modules, or printed circuit boards (PCBs), when available.

(c) Operating a repair parts program to include Class VIII repair parts as well as other commodity class repair parts used on medical equipment.

(d) Maintaining a library of technical manuals (TMs), manufacturers' literature, repair parts information, and related materials.

(e) Conducting inspections on new or transferred equipment.

(f) Establishing administrative procedures for the control and administration of maintenance services in accordance with TB 38-750-2.

(g) Notifying support maintenance battalions of requirements and/or evacuating unserviceable equipment, assemblies, or modules.

b. Maintenance functions. Maintenance functions, both preventive and corrective, which are beyond the scope of the operator/user are assigned to unit level Maintenance Equipment Repairer personnel. These personnel will perform the majority of maintenance required for the equipment except some tasks involving the PCBs, visual display, and case components.

3-2. Tools and test equipment.

Common tools and test equipment required for unit level maintenance of the equipment are listed in appendix B, section III of this manual. Refer to your unit's modified table of organization and equipment (MTOE) for authorized items.

3-3. Components of end item and basic issue items.

Components of end item and basic issue items are listed in appendix C, sections II and III of this manual.

3-4. Expendable supplies.

Expendable and durable supplies and materials required for maintenance of the equipment are listed in appendix D, section II of this manual.

3-5. Repair parts.

Repair parts required for unit level maintenance are listed in appendix E, section II of this manual.

3-6. Special tools.

Special tools required for unit level maintenance of the equipment are listed in appendix E, section III of this manual.

Section II. SERVICE UPON RECEIPT OF EQUIPMENT

3-7. Unpacking the thermometer unit.

- a. Cut the sealing tape on the cardboard shipping container.
- b. Open the top flaps of the container.
- c. Remove foam blocks, which contain the thermometer unit, from inside cardboard container.
- d. Take thermometer unit out of the foam blocks. Set the foam blocks aside.
- e. Check the thermometer system for any damage that may have occurred during shipping.
- f. Verify receipt of the following items:
 - (1) Thermometer unit.
 - (2) Maintenance and service manuals, 2 each.
 - (3) Operators manuals, 2 each.
 - (4) Green probe with wire and connector.
 - (5) Red probe with wire and connector.
 - (6) Probe covers (4 boxes containing 250 probe covers each).
 - (7) Wall bracket (to hold probe cover box).

Section III. LUBRICATION INSTRUCTIONS

3-8. General.

No lubrication of the thermometer is required.

Section IV. PREVENTIVE MAINTENANCE CHECKS AND SERVICES

3-9. General.

a. The thermometer must be inspected and serviced systematically to ensure that it is ready for operation at all times. Inspection will allow defects to be discovered and corrected before they result in serious damage or failure.

b. Table 3-1 contains a list of items to be performed by unit level operator/user personnel. This PMCS table is also referred to as "-10 PMCS" requirements. Preventive maintenance by operator/user personnel is not limited to performing the checks and services in table 3-1. There are things operator/user personnel should do any time they need to be done, such as checking general cleanliness, observing for improper operational indicators, and maintaining the proper quantities of accessories.

c. Table 3-2 contains a list of items to be performed by unit level Medical Equipment Repairers. This PMCS table is also referred to as "-20 PMCS" requirements.

d. Some items to be inspected will be listed in both table 3-1 and table 3-2 to stress their importance, to provide a quality control check on multiple operator/user personnel, and to identify more comprehensive procedures to be accomplished by unit level Medical Equipment Repairers.

e. The following is a list of both PMCS table column headings with a description of the information found in each column:

(1) *Item number.* This column shows the sequence in which to do the PMCS, and is used to identify the equipment area on the Equipment Inspection and Maintenance Worksheet, DA Form 2404.

(2) *Interval.* This column shows when each PMCS item is to be serviced: **B** - Before Operation, **D** - During Operation, **A** - After Operation, **Q** - Quarterly, and **S** - Semiannually. **B**, **D**, and **A** should be performed with daily use of the equipment.

(3) *Item to be Inspected and Procedure.* This column identifies the general area or specific part to be checked or serviced.

(4) *Equipment is not Ready/Available If.* This column lists conditions that make the equipment unavailable or unusable.

Table 3-1. Operator preventive maintenance checks and services.

ITEM NO	INTERVAL					ITEM TO BE INSPECTED AND PROCEDURE	EQUIPMENT IS NOT READY/AVAILABLE IF:
	B	D	A	Q	S		
1	X			X		Probe & cable assembly. Check for a damaged/frayed probe cable, damaged probe, or a defective electrical connector.	Probe, cable, or electrical connector is damaged.
2	X			X		Thermometer instrument. a. Verify that the unit powers on when probe is removed from storage well. b. Verify that all segments are visible on the LCD. c. Ensure that the unit performs and passes the internal calibration test by verifying that 84.0°F or 28.9°C (±0.2) is displayed on the LCD after completion of the 6-second startup display test.	Unit does not turn on. Batteries are low or incorrectly installed. Segments on the LCD are missing or are faded. A malfunction error is displayed.

Table 3-2. Repairer preventive maintenance checks and services.

ITEM NO	INTERVAL					ITEM TO BE INSPECTED AND PROCEDURE	EQUIPMENT IS NOT READY/AVAILABLE IF:
	B	D	A	Q	S		
1					X	Probe & cable assembly. a. Check for a damaged/frayed probe cable. b. Inspect probe for corrosion, damage, or deterioration. c. Inspect the probe electrical connector for corrosion or other defects.	Probe cable is damaged. Probe is damaged or defective. Electrical connector is damaged or defective.
2					X	Thermometer instrument. a. Verify that the unit powers on when probe is removed from storage well. b. Verify that all segments, except for the pulse timer, are visible on the LCD during the startup display test. c. Verify that the horn sounds for 0.1 second during the startup display test. d. Ensure that the unit performs and passes the internal calibration test by verifying that 84.0°F or 28.9°C (±0.2) is displayed on the LCD after completion of the 6-second startup display test. e. Verify normal mode of operation. Verify that a continuously increasing temperature is displayed until the final temperature is reached. f. Verify monitor mode of operation. Verify that an "M" is displayed on the LCD when operating in this mode. g. Verify that the °F/°C conversion switch operates properly. h. Verify operation and accuracy of the pulse timer and horn with a stop watch. i. Verify operation of the backlight switch. j. Verify thermometer system accuracy by performing the water bath test. (Refer to section IX.)	Unit does not turn on. Batteries are low (below 3 volts) or incorrectly installed. One or more segments are missing. Horn does not sound. A malfunction error is displayed. Unit does not display accurate temperatures. Unit does not display accurate temperatures. Unit does not convert properly. Pulse timer or horn does not function properly. Backlight is dim or does not glow behind the LCD. Unit does not display accurate temperatures.

3-10. Reporting deficiencies.

Operator/user personnel will report problems with the thermometer discovered during their "-10 PMCS" that they are unable to correct. Refer to TB 38-750-2 and report the deficiency using the proper forms. Consult with your unit's Medical Equipment Repairer or request help through the telemaintenance system if you need assistance.

Section V. OPERATIONAL TESTING

3-11. General.

This section contains procedures for operational testing of the thermometer by both operator/user personnel and Medical Equipment Repairer personnel. Deficiencies identified by operator/user personnel should be reported to Medical Equipment Repairer personnel.

3-12. Operator/user tests.

- a. Ensure that the batteries are installed properly.
- b. Connect a probe (with wire and connector) to thermometer unit. Check that the connection is secure.
- c. Place probe into probe storage well. (Unit is off.)
- d. Switch normal/monitor switch to normal position.
- e. Select temperature scale (either °F or °C).
- f. Remove probe from storage well. (Unit is on.)
- g. Observe the display for 6 seconds.
- h. Ensure that the horn sounds for 0.1 second.
- i. Check that no display segments are missing or blurred.
- j. The unit will display 84.0°F (28.9°C) with the low temperature arrow shown until the temperature rises above 84.0°F.
- k. Notify your unit's Medical Equipment Repairer if you observe any abnormal operation.

3-13. Medical Equipment Repairer tests.

- a. Perform all of the operator/user tests (para 3-12).
- b. Test the display and horn.
 - (1) Each time the probe is removed from its holder all display segments (except for the pulse timer) are lighted for 6 seconds as a display test.
 - (2) During the display test the horn sounds for 0.1 second.
- c. Perform internal calibration test.
 - (1) During each thermometer start-up display test a precision resistor is used to check the thermometer calibration at 84.0°F (28.9°C).
 - (2) A failure of the thermometer to measure the calibration resistor with $\pm 0.2^\circ\text{F}$ will cause the malfunction error to flash, the horn will sound with a double beep every 10 seconds and no temperature measurement will be allowed.
 - (3) The thermometer will automatically shut off after 5 minutes of the error display.
- d. Perform internal microprocessor test.
 - (1) During each thermometer display test a check sum of all program memory is calculated and compared against a reference stored in the program memory.

(2) An error in the check sum will cause the malfunction error to flash, the horn will sound with a double beep every 10 seconds, and no temperature measurement will be allowed.

(3) The thermometer will shut off after 5 minutes of the error display.

e. Thermometer system calibration test.

(1) In order to accurately check the calibration of a thermometer system (thermometer, probe, and batteries), a calibrated constant temperature heat source is required.

(2) A water bath can be used to calibrate the thermometer (for example, Thermomix 1480, manufactured by B. Braun or equivalent). Accurately calibrate the water bath to 100.4°F ±0.02°F (38.0°C ±0.01°C).

(3) Once the temperature of the water bath has been verified to be 100.4°F (38.0°C) insert the probe shaft, without the probe cover, approximately two inches into the water.

(4) Place thermometer in monitor mode. After approximately 3 minutes the display should read 100.4°F ±0.2°F (38.0°C ±0.1°C).

Section VI. TROUBLESHOOTING

3-14. General.

a. Troubleshooting information for thermometer operator/user personnel and for Medical Equipment Repairer personnel is provided in this section. Corrective maintenance beyond the capability or authority of operator/user personnel will be indicated by the phrase "Notify your unit's Medical Equipment Repairer."

b. This manual cannot list all possible malfunctions. If a malfunction is either not listed or is not determined by routine diagnostic procedures, notify your appropriate maintenance support unit.

3-15. Operator/user troubleshooting.

Operator/user troubleshooting procedures are provided in table 3-3. Each symptom is followed by possible causes and corrective maintenance.

Table 3-3. Operator/user troubleshooting.

SYMPTOM

POSSIBLE CAUSES

CORRECTIVE MAINTENANCE

1. THERMOMETER DOES NOT OPERATE (NO DISPLAY).

Batteries installed incorrectly.

Remove and reinstall batteries.

Batteries are defective.

Replace batteries with new batteries.

2. NO TEMPERATURE DISPLAY (TIMER OK).

Probe plug not seated.

Reseat plug.

Probe plug defective.

Notify your unit's Medical Equipment Repairer.

Table 3-3. Operator/user troubleshooting - continued.

Broken wire to probe.
Notify your unit's Medical Equipment Repairer.
Bent or broken probe.
Notify your unit's Medical Equipment Repairer.
Probe switch not activating.
Notify your unit's Medical Equipment Repairer.
3. MISSING OR FADED DISPLAY SEGMENTS.
Defective LCD.
Notify your unit's Medical Equipment Repairer.
4. BROKEN PROBE INDICATION.
Defective probe.
Notify your unit's Medical Equipment Repairer.
Bad Q6 FET.
Notify your unit's Medical Equipment Repairer.
5. MALFUNCTION INDICATION.
Unit cannot self calibrate.
Notify your unit's Medical Equipment Repairer.
Microprocessor has a malfunction.
Notify your unit's Medical Equipment Repairer.

3-16. Medical Equipment Repairer troubleshooting.

Medical Equipment Repairer troubleshooting procedures are provided in table 3-4. Each symptom is followed by possible causes and corrective maintenance.

Table 3-4. Medical Equipment Repairer troubleshooting.

SYMPTOM
POSSIBLE CAUSE
CORRECTIVE MAINTENANCE
1. NO TEMPERATURE OR TIMER DISPLAY.
Batteries installed incorrectly.
Remove and reinstall batteries.
Batteries are defective.
Replace batteries with new batteries.
Battery contacts corroded or defective.
Clean, replace, or repair contacts.

Table 3-4. Medical Equipment Repairer troubleshooting - continued.

2. LOW BATTERY INDICATION.

Battery power has been used up.

Replace batteries with new batteries.

3. NO TEMPERATURE DISPLAY (TIMER OK).

Probe plug not seated.

Reseat plug.

Probe plug defective.

Replace plug, cord, and probe. Calibrate unit.

Broken wire to probe.

Replace plug, cord, and probe. Calibrate unit.

Bent or broken probe.

Replace plug, cord, and probe. Calibrate unit.

Probe switch not activating.

Troubleshoot S1 circuit or replace S1.

4. MISSING OR FADED DISPLAY SEGMENTS.

Defective LCD.

Replace LCDs.

LCD connector flex strip defective.

Locate, repair, or replace defective strip.

U2 defective.

Troubleshoot and replace U2.

5. BROKEN PROBE INDICATION.

Defective probe.

Replace plug, cord, and probe. Calibrate unit.

Defective or bad Q6.

Troubleshoot and/or replace Q6.

6. MALFUNCTION INDICATION.

Unit cannot self calibrate.

Troubleshoot and/or replace Q3, Q4, Q5, C2, R3, R4, R5, or U2.

3-17. Electrical diagrams.

An electrical block diagram (fig 3-1) is provided to assist you when troubleshooting.

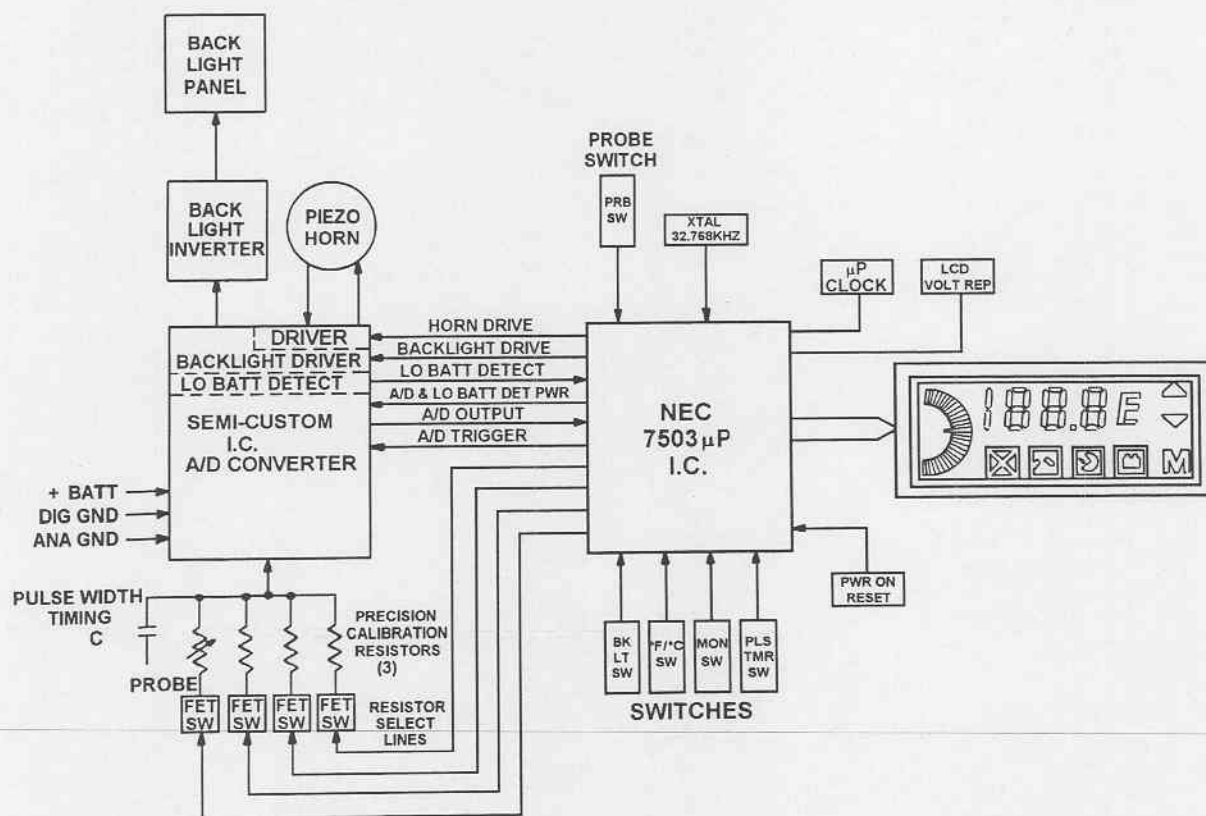


Figure 3-1. Block diagram.

Section VII. CIRCUIT DESCRIPTIONS

3-18. General.

Circuit descriptions are provided for the functional segments as well as individual component identifications.

3-19. Temperature measurement and display.

a. When batteries are installed in the thermometer, C4 and R10 provide a power on reset pulse to the microprocessor (U2-56). C3 and R9 set the microprocessor clock frequency at approximately 200 KHz. Following the high going reset pulse, the microprocessor initiates the power display test which causes display segments (DS1) to be sequentially lighted for 0.4 seconds and then extinguished. After the completion of the display test which lasts approximately 25 seconds, the microprocessor then goes into a sleep mode awaking 8 times per second to test the probe switch S1. If the probe is in the thermometer (S1 open) or the probe is disconnected, then the microprocessor returns to sleep for another 1/8 of a second. The pulse timer switch (S5) is connected to an interrupt input on the microprocessor (U2-63) and will wake up the microprocessor and start the 30 second pulse timer.

b. In the sleep mode and even when only the pulse timer is active, the 200 KHz clock (U2-59) will be seen to turn on for about 2 milliseconds every 1/8 of a second. If when tested, the probe switch circuit is found to be active, the microprocessor turns on all display segments except the 30 second pulse timer simultaneously.

c. During the display test the following events take place.

- (1) The A/D power control line (U2-3) is set high by the microprocessor to turn on the power to U1.
- (2) The low battery detector output (U1-9) is tested by the microprocessor. A low logic level on U1-9 indicates a low battery condition (less than 3.0 volts).
- (3) The horn drive signal (U2-11) goes high activating the horn test for 0.1 second.
- (4) The backlight switch, normal/monitor switch and °F/°C switches are tested by the microprocessor.
- (5) A calibration cycle is performed.
- (6) A calibration test is performed.
- (7) The microprocessor memory test is performed.
- (8) The probe resistance is tested for an open or shorted condition.

d. Following the events which take place during the display test, a continuous monitor mode temperature measurement or a predict mode temperature taking cycle is started.

3-20. Probe temperature measurement.

a. Q3-Q6, R3-R5, C2 and U1 comprise a unique resistance to pulse width conversion circuit which allows anyone of four resistances to be measured by the microprocessor. The circuit allows the microprocessor to select precision resistors with equivalent temperatures at opposite ends of the temperature measurement range and measure their relative pulse widths.

b. The microprocessor sets U2-16 to 19 high as required to select the appropriate resistance to be measured. R3 provides a pulse width calibration at 93.2°F, R5 provides calibration at 106.9°F and R3 is used for a calibration test at 100.5°F. A ratiometric calculation is used to compute the probe resistance from its pulse width relative to those provided by R3 and R5. The accuracy of each calibration resistor is .05°F. A resistance to pulse width conversion is initiated by the microprocessor setting U2-64 high for approximately 0.5 seconds with the appropriate FET switch selected sometime within that period. U2-64 is then set low and the time from this transition until the A/D output (U1-2) goes high is measured by the microprocessor. The crystal X1 provides the time base for the pulse width measurements. The probe temperature is computed using the probe resistance value obtained from the ratiometric pulse width calculations.

3-21. Monitor mode operation.

In the monitor mode a new probe temperature measurement is completed every 1.5 seconds and a new calibration cycle is completed every 3 seconds. The computed probe temperature is displayed directly on the LCD and will follow both upward and downward movement.

3-22. Normal mode operation.

a. In the normal mode, a new probe temperature measurement is completed every 1.5 seconds. At least one calibration cycle is performed at the start of a predict cycle and continue every 3 seconds until the probe temperature rises above 84.0°F. The calibration cycle is stopped at this point to reduce quantizing errors associated with the measurement of the slowly changing probe temperature.

b. The normal mode displayed temperature is the sum of the actual probe temperature and a computed correction factor which is based on the shape of the changing temperature curve at that point in time. The values of the correction factor can vary from 0°F to 2.3°F with a typical value when the horn sounds of about 1°F. During the display test prior to starting a normal mode temperature cycle, the ambient temperature of the probe is measured and is used in the correction factor computation to adjust for differing probe starting conditions. The normal mode display is peak reading and therefore the highest temperature is displayed even

though the present predicted probe temperature may drop. The normal mode temperature cycle is terminated when the predicted temperature remains stable for several seconds.

3-23. Internal calibration test.

The calibration test is performed only once during a temperature taking cycle and occurs during the display test. Upon completion of the first calibration cycle, the resistance of R4 is measured and compared against limits stored in the microprocessor memory. The specified limits are 5740 and 5780 ohms. If the resistance calculated by the microprocessor when the pulse width of R4 is measured does not fall within these limits, the malfunction error is displayed.

3-24. Internal microprocessor memory test.

The microprocessor memory test is performed only once during a temperature taking cycle and occurs during the display test. Each 8-bit byte of program memory is divided into two 4-bit nibbles which are summed. The total sum of all nibbles and special check sum compensation nibble must be 0 or the malfunction error is displayed.

3-25. Broken probe test.

Each probe resistance sample that is taken is checked to see that it lies between 2,000 and 60,000 ohms. A resistance value outside of these limits will cause a broken probe error to be displayed.

3-26. Display voltage reference.

a. Diodes CR2-CR6, Q7, R11, and R14 create the display voltage references of about (V+)-1 volt at U2-25, (V+)-2 volts at U2-24 and (V+)-3 volts at U2-25.

b. The LCD is of the backplane multiplexed type (quadraplex), requires a regulated operating voltage, and is driven directly by the microprocessor.

3-27. Horn.

The microprocessor provides a control signal to U1-3 which is the feedback input for the horn driver contained in U1. The horn driver output (U1-1) drives the horn (H1) at its self resonant frequency of about 6 KHz.

3-28. Backlight.

The microprocessor activates the backlight by setting U2-4 high (high from S4 to U2-12). This signal is inverted and buffered and reappears at U1-13 going low. A low level on U1-13 turns on the backlight inverter circuit consisting of Q1, Q2, R1, R2, C5, and T1. The inverter supplies an AC voltage of about 80 volts and 300 Hz to the electroluminescent panel BP1. CR7 blocks negative voltage spikes from entering U1-13.

3-29. Power consumption.

a. Without the thermometer or pulse timer active the average battery current should be under 50 microamperes. When the thermometer function is active the average battery current should be about 1 milliampere.

b. Maximum battery current with the light on should be about 20 milliamperes.

3-30. Low battery detection.

When the battery voltage is reduced to 3.2 volts, U1-9 goes low indicating a low battery condition to the microprocessor which in turn causes the low battery indication to be displayed.

3-31. Pulse timer operation.

Pressing the pulse timer switch (S5) activates the microprocessor interrupt to (U2-63) starting the pulse timer display. The pulse timer input is independent from the temperature taking functions and may be activated at any time. Starting the pulse timer causes the microprocessor to turn on the horn for 0.1 seconds at 0, 15, and 30 seconds and light one additional clock segment each second until the display is fully lighted at 30 seconds at which time the clock display blanks. The timer cannot be restarted for 1.5 seconds following the last press of the timer switch but may be restarted at any later time.

Section VIII. REPAIR PROCEDURES

3-32. Maintenance information.

a. Procedures for disassembly, repair, or replacement of components, services, and reassembly are provided in this section of the manual.

b. Repair procedures are continuous from the first disassembly to the final reassembly step.

3-33. Batteries.

a. Remove the battery access screw (4-40 X 1 in) by turning it counterclockwise with a Phillips screwdriver.

b. Slide the battery access cover away from the battery access label to expose the batteries (fig 3-2).

c. Verify the batteries are low in voltage. Check the voltage with a digital DC voltmeter. The voltage should be higher than 3.2 volts DC.

d. Acquire three new alkaline batteries.

e. Install new batteries.

CAUTION

Ensure the batteries are installed correctly by paying special attention to the "+" and "-" marks in the battery compartment.

f. Slide the battery compartment cover into the main housing.

g. Replace battery compartment screw by turning it clockwise with a Phillips screwdriver.

h. Test the unit for proper operation.

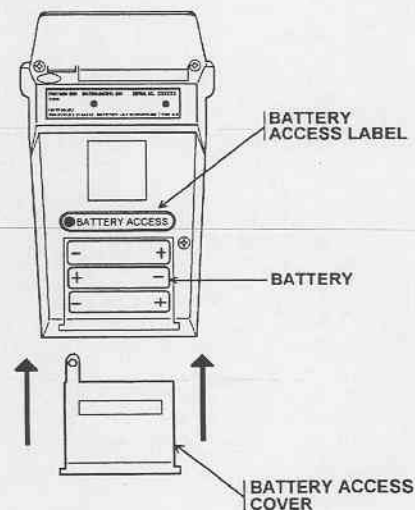


Figure 3-2. Battery access.

3-34. Case back (fig 3-3).

a. Turn unit OFF by removing probe plug from the thermometer receptacle.

b. Remove battery access screw by turning it counterclockwise with a Phillips screwdriver.

c. Slide the battery access cover away from the battery access label to expose the batteries.

d. Remove batteries from compartment.

e. Remove the three plastilock screws (4 X 3/4 in) from the back of the housing by turning them counterclockwise with a Phillips screwdriver.

f. Remove defective case back from unit. Be careful not to damage any components. Keep the neck strap to replace on new case back.

- g. Replace neck strap into the neck strap grooves of the new case back.
- h. Carefully assemble the case back with the case front. Be careful not to damage any components.
- i. Replace the three plastilock screws by turning them clockwise with a Phillips screwdriver. Do not over tighten as the threads can be stripped easily.
- j. Install the batteries into the battery compartment.
- k. Replace the battery compartment cover by sliding it toward the battery access label.
- l. Replace battery compartment screw by turning it clockwise with a Phillips screwdriver. Do not over tighten as the threads can be stripped easily.
- m. Replace probe plug into thermometer receptacle. This turns the unit ON.
- n. Test the unit for proper operation.

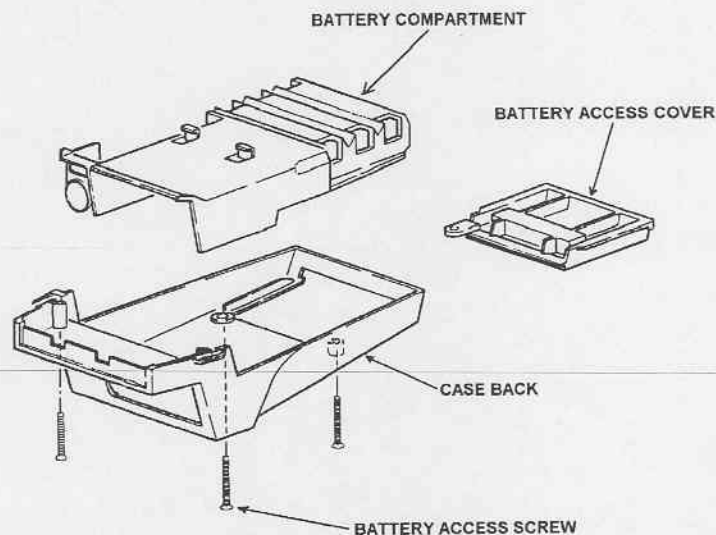


Figure 3-3. Case back removal.

3-35. Case front (fig 3-4).

- a. Turn unit OFF by removing probe plug from the thermometer receptacle.
- b. Remove the battery access screw by turning it counterclockwise with a Phillips screwdriver.
- c. Slide the battery access cover away from the battery access label to expose the batteries.
- d. Remove the batteries from the battery compartment.
- e. Remove three plastilock (4 X ¼ in) screws from the back of the housing by turning them counterclockwise with a Phillips screwdriver.
- f. Remove the case back from unit. Be careful not to damage any components. Keep neck strap on case back.
- g. Remove two (4 X ¼ in) plastilock screws holding the LCD display on the case front.
- h. Remove the LCD display and the PCB together from the defective case front. Be careful not to damage any components.
- i. Replace the LCD and PCB on the new case front.
- j. Replace the two plastilock screws that hold the LCD onto the case front.
- k. Assemble case back and case front together making sure the neck strap is in place.

- l. Insert the three plastilock screws into the back case by turning them clockwise with a Phillips screwdriver. Do not over tighten as the threads can be stripped easily.
- m. Install the batteries into the battery compartment.
- n. Replace the battery compartment cover by sliding it toward the battery access label.
- o. Insert the battery compartment screw into the case back. Screw it clockwise with a Phillips screwdriver. Do not over tighten as the threads can be stripped easily.
- p. Replace the probe plug into the thermometer receptacle. This turns the unit ON.
- q. Test the unit for proper operation.

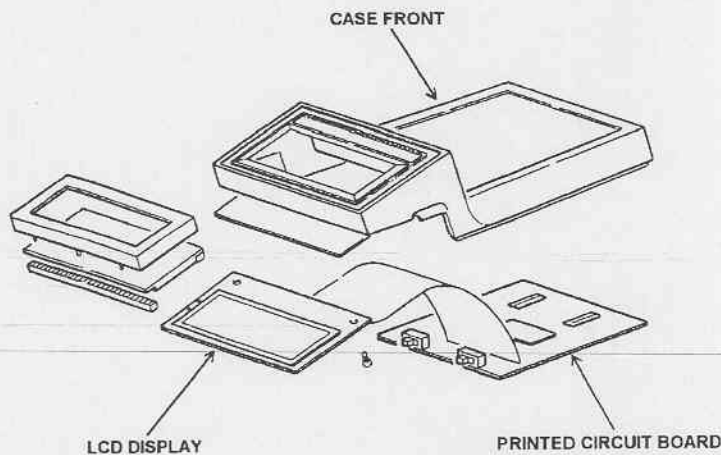


Figure 3-4. Case front removal.

3-36. Probe switch S1 (fig 3-5).

- a. Turn the unit OFF by removing probe plug from the thermometer receptacle.
- b. Remove the battery access screw by turning it counterclockwise with a Phillips screwdriver.
- c. Slide the battery access cover away from the battery access label to expose the batteries.
- d. Remove the batteries from the battery compartment.
- e. Remove the three plastilock screws (4 X 3/4 in) from back of housing by turning counterclockwise with a Phillips screwdriver.
- f. Remove two (4 X 1/4 in) plastilock screws holding the LCD display on the case front.
- g. Pull PCB away from the case front to gain access to S1 solder joints.
- h. Unsolder the defective S1 and remove it from the PCB.
- i. Clean solder holes with a solder sucker or solder wick. This will help in the installation of a new switch.
- j. Obtain a new switch and install and solder it on the PCB. Leads on the switch may need to be bent and cut to fit properly.
- k. Replace the two plastilock screws that hold the LCD onto the case front.
- l. Assemble the case back and case front together making sure the neck strap is in place.

- m. Insert the three plastilock screws into the back case by turning them clockwise with a Phillips screwdriver. Do not over tighten as the threads can be stripped easily.
- n. Install the batteries into the battery compartment.
- o. Replace the battery compartment cover by sliding it toward the battery access label.
- p. Insert the battery compartment screw into the case back. Screw it clockwise with a Phillips screwdriver. Do not over tighten as the threads can be stripped easily.
- q. Replace the probe plug into the thermometer receptacle. This turns the unit ON.
- r. Test the unit for proper operation.

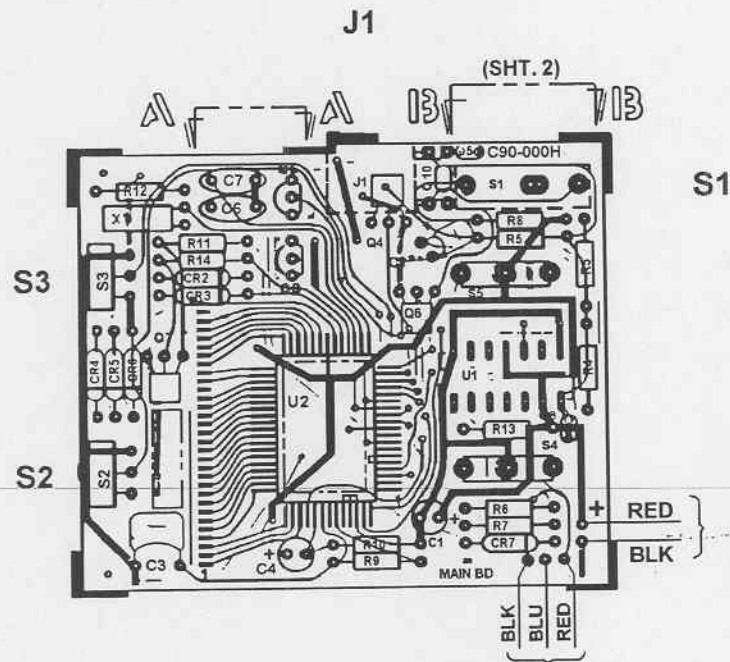


Figure 3-5. PCB component layout.

3-37. Switch S2, °F to °C (fig 3-5).

- a. Turn the unit OFF by removing the probe plug from the thermometer receptacle.
- b. Remove the battery access screw by turning it counterclockwise with a Phillips screwdriver.
- c. Slide the battery access cover away from the battery access label to expose the batteries.
- d. Remove the batteries from the battery compartment.
- e. Remove the three plastilock screws (4 X 3/4 in) from the back of the housing by turning them counterclockwise with a Phillips screwdriver.
- f. Remove the case back from the unit. Be careful not to damage any components. Keep the neck strap on the case back.
- g. Unsolder the defective S2 and remove it from the PCB.
- h. Clean solder holes with a solder sucker or solder wick. This will help in the installation of a new switch.
- i. Obtain a new switch and install it on the PCB.
- j. Solder the electrical leads to the PCB.
- k. Assemble the case back and case front together making sure the neck strap is in place.

- l.* Insert the three plastilock screws into the back case by turning them clockwise with a Phillips screwdriver. Do not over tighten as the threads can be stripped easily.
- m.* Install the batteries into the battery compartment.
- n.* Replace the battery compartment cover by sliding it toward the battery access label.
- o.* Insert the battery compartment screw into the case back. Screw it clockwise with a Phillips screwdriver. Do not over tighten as the threads can be stripped easily.
- p.* Replace the probe plug into the thermometer receptacle. This turns the unit ON.
- q.* Test the unit for proper operation.

3-38. Switch S3, Normal to Monitor (fig 3-5).

- a.* Turn the unit OFF by removing the probe plug from the thermometer receptacle.
- b.* Remove the battery access screw by turning it counterclockwise with a Phillips screwdriver.
- c.* Slide the battery access cover away from the battery access label to expose the batteries.
- d.* Remove the batteries from the battery compartment.
- e.* Remove the three plastilock screws (4 X $\frac{3}{4}$ in) from the back of the housing by turning them counterclockwise with a Phillips screwdriver.
- f.* Remove the case back from the unit. Be careful not to damage any components. Keep the neck strap on the case back.
- g.* Unsolder the defective S3 and remove it from the PCB.
- h.* Clean solder holes with a solder sucker or solder wick. This will help in the installation of a new switch.
- i.* Obtain a new switch and install it on the PCB.
- j.* Solder the leads to the PCB.
- k.* Assemble the case back and case front together making sure the neck strap is in place.
- l.* Insert the three plastilock screws into the back case by turning them clockwise with a Phillips screwdriver. Do not over tighten as the threads can be stripped easily.
- m.* Install the batteries into the battery compartment.
- n.* Replace the battery compartment cover by sliding it toward the battery access label.
- o.* Insert the battery compartment screw into the case back. Screw it clockwise with a Phillips screwdriver. Do not over tighten as the threads can be stripped easily.
- p.* Replace the probe plug into the thermometer receptacle. This turns the unit ON.
- q.* Test the unit for proper operation.

3-39. Probe receptacle, J1 (fig 3-5).

- a.* Turn the unit OFF by removing the probe plug from the thermometer receptacle.
- b.* Remove the battery access screw by turning it counterclockwise with a Phillips screwdriver.
- c.* Slide the battery access cover away from the battery access label to expose the batteries.
- d.* Remove the batteries from the battery compartment.
- e.* Remove the three plastilock screws (4 X $\frac{3}{4}$ in) from the back of the housing by turning them counterclockwise with a Phillips screwdriver.
- f.* Remove the case back from the unit. Be careful not to damage any components. Keep the neck strap on the case back.
- g.* Lift up the PCB to gain access to solder joints of the female probe plug.
- h.* Desolder the leads using a solder sucker or solder wick.

- i. Clean the solder holes prior to installing new receptacle.
- j. Obtain a new receptacle and install it on the PCB. The electrical leads may need to be cut and bent to fit on the PCB.
- k. Assemble the case back and case front together making sure the neck strap is in place.
- l. Insert the three plastilock screws into the back case by turning them clockwise with a Phillips screwdriver. Do not over tighten as the threads can be stripped easily.
- m. Install the batteries into the battery compartment.
- n. Replace the battery compartment cover by sliding it toward the battery access label.
- o. Insert the battery compartment screw into the case back. Screw it clockwise with a Phillips screwdriver. Do not over tighten as the threads can be stripped easily.
- p. Replace the probe plug into the thermometer receptacle. This turns the unit ON.
- q. Test the unit for proper operation.

Section IX. VERIFICATION OF CALIBRATION

3-40. Probe thermistor resistance verification (model 140/150).

a. In order to accurately check the probe assembly, a calibrated constant temperature heat source is required. For this purpose we suggest a water bath (Thermomix 1480, manufactured by B. Braun or equivalent) accurately calibrated at $100.4^{\circ}\text{F} \pm 0.02^{\circ}\text{F}$ ($38.0^{\circ}\text{C} \pm 0.02^{\circ}\text{C}$).

b. Once the temperature of the water bath has been verified to be 100.4°F (38.0°C), insert the probe shaft approximately two inches into the water (do not cover the probe shaft with a probe cover). Allow the thermistor 35 seconds to stabilize. Using a calibrated resistance meter, check across the two gold metal contacts on opposite corners of the probe connector PCB. The resistance should read between 5.763 ohms and 5.792 ohms. If a reading of near zero resistance is obtained, try the other opposite corners.

NOTE

Long-term testing of a probe in this manner can cause self heating of the thermistor unless a low current meter is used.

3-41. Thermometer system accuracy verification (1-600 thermometer, 1-140/150 probe).

a. In order to accurately check the calibration of a thermometer system (thermometer, probe, and batteries), a calibrated constant temperature heat source is required. See para 3-40a.

b. Once the temperature of the water bath has been verified to be 100.4°F (38.0°C), insert the probe shaft, without the probe cover, approximately two inches into the water. Place the thermometer in the monitor mode. After approximately three minutes the display should read $100.4^{\circ}\text{F} \pm 0.02^{\circ}\text{F}$ ($38.0^{\circ}\text{C} \pm 0.02^{\circ}\text{C}$).

Section X. STORING AND SHIPPING PROCEDURES

3-42. Preparation for storing.

a. Shut-down procedures for the thermometer are as follows:

- (1) Ensure that the probe is in the probe storage well.
- (2) Disconnect the electrical probe cable from the main case assembly. This ensures the unit is off.

(3) Remove batteries from battery compartment. Store batteries separate from thermometer in a refrigerator.

(4) Clean the thermometer in accordance with the procedures in chapter 2, section V.

b. Inventory the components. Replace unserviceable or missing items.

c. Pack the thermometer and components into its storing/shipping carton or another available container.

3-43. Preparation for shipping.

a. The thermometer, packed in the original shipping carton, is suitable for shipping.

b. The thermometer, packed in a military chest or other available container, will also be appropriately packed for shipping. Notify your unit transportation point for assistance, if necessary.

CHAPTER 4

DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE

Section I. GENERAL INFORMATION

4-1. Overview.

This chapter provides for maintenance that is beyond the capability, capacity, and authorization for unit level maintenance personnel. The procedures in this chapter should not be attempted at the unit level.

4-2. Tools and test equipment.

Common tools and test equipment required for support maintenance of the equipment are listed in appendix B, section III. Refer to your unit's MTOE or installation table of distribution and allowances (TDA) for authorized items.

4-3. Components of end item and basic issue items.

Components of end item and basic issue items are listed in appendix C, sections II and III.

4-4. Expendable supplies.

Expendable and durable supplies and materials for support maintenance are listed in appendix D, section II.

4-5. Repair parts.

Repair parts required for support maintenance are listed in appendix E, section II.

4-6. Special tools.

Special tools required for support maintenance are listed in appendix E, section III.

Section II. MAINTENANCE PROCEDURES

4-7. General.

- a. There are no specific troubleshooting procedures for DS/GS levels of maintenance.
- b. Rebuild procedures for the thermometer have not been developed.

APPENDIX A

REFERENCES

A-1. Army regulations.

AR 40-61	Medical Logistics Policies and Procedures
AR 710-2	Supply Policy Below the Wholesale Level
AR 725-50	Requisitioning, Receipt, and Issue System
AR 750-1	Army Materiel Maintenance Policy and Retail Maintenance Operations

A-2. Technical manual.

TM-DPSC-6500-RPL	Medical Materiel: Medical Repair Parts Reference List
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A-3. Technical bulletins.

TB MED 7	Maintenance Expenditure Limits for Medical Materiel
TB 8-6500-MPL	Mandatory Parts List for Medical Equipment
TB 38-750-2	Maintenance Management Procedures for Medical Equipment
TB 740-10/DLAM 4155.5/AFR 67-43	Quality Control, Depot Storage Standards, Appendix M, Medical Supplies

A-4. Field manual.

FM 21-11	First Aid for Soldiers
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A-5. Supply bulletin.

SB 8-75-()-series	Army Medical Department Supply Information
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A-6. Other publication.

(This publication may be obtained from U.S. Army Medical Materiel Agency, 1423 Sultan Drive, Suite 100, ATTN: MCMR-MMM, Fort Detrick, MD 21702-5001.)

Operator and Service Manual (1990), Diatek Inc., Model 600 Thermometer System Technical Manual, 70017-000C, Diatek Corporation, San Diego, CA 92121.

APPENDIX B

MAINTENANCE ALLOCATION CHART

Section I. INTRODUCTION

B-1. General.

- a. This section provides a general explanation of all maintenance and repair functions authorized at various maintenance levels.
- b. Section II designates overall responsibility for the performance of maintenance functions on the identified end item or component. The implementation of the maintenance functions upon the end item or component will be consistent with the assigned maintenance levels.
- c. Section III lists the tools and test equipment required for each maintenance function as referenced from Section II.
- d. Section IV contains supplemental instructions, explanatory notes, and/or illustrations required for a particular maintenance function.

B-2. Explanation of columns in section II.

- a. *Group Number, Column 1.* The assembly group number (Group No.) column is a numerical group assigned to each assembly. The applicable assembly groups are listed in the maintenance allocation chart (MAC) in disassembly sequence beginning with the first assembly removed in a top down disassembly sequence.
- b. *Assembly Group, Column 2.* This column contains a brief description of the components of each assembly group.
- c. *Maintenance Functions, Column 3.* This column lists the various maintenance functions (A through K) and indicates the lowest maintenance level authorized to perform these functions. The symbol designations for the various maintenance levels are as follows:
 - C - Operator or crew
 - O - Unit maintenance
 - F - Direct support maintenance
 - H - General support maintenance
 - D - Depot maintenance

The maintenance functions are defined as follows:

- A - Inspect. To determine serviceability of an item by comparing its physical, mechanical, and electrical characteristics with established standards.
- B - Test. To verify serviceability and to detect electrical or mechanical failure by use of test equipment.
- C - Service. To clean, to preserve, to charge, and to add lubricants, cooling agents, and air. If it is desired that elements such as painting and lubricating be defined separately, they may be so listed.
- D - Adjust. To rectify to the extent necessary to bring into proper operating range.
- E - Align. To adjust specified variable elements of an item to bring it to optimum performance.
- F - Calibrate. To determine the corrections to be made in the readings of instruments or test equipment used in precise measurement. Consists of the comparison of two instruments, one of which is a certified standard of known accuracy, to detect and adjust any discrepancy in the accuracy of the instrument being compared with the certified standard.

G - Install. To set for use in an operational environment such as tents or International Standards Organization shelters.

H - Replace. To replace unserviceable items with serviceable like items.

I - Repair. Those maintenance operations necessary to restore an item to serviceable condition through correction of material damage to a specific failure. Repair may be accomplished at each level of maintenance.

J - Overhaul. Normally the highest degree of maintenance performed by the Army in order to minimize time work in process consistent with quality and economy of operation. It consists of that maintenance necessary to restore an item to completely serviceable condition as prescribed by a maintenance standard in technical publications for each item of equipment. Overhaul normally does not return an item to like new condition.

K - Rebuild. The highest degree of material maintenance. It consists of restoring equipment as nearly as possible to new condition in accordance with original manufacturing standards. Rebuild is performed only when required by operational considerations or other paramount factors and then only at the depot maintenance level.

d. *Tools and Equipment, Column 4.* This column is provided for referencing by code, the tools and test equipment (sec III) required to perform the maintenance functions.

e. *Remarks, Column 5.* This column is provided for referencing by code, the remarks (sec IV) pertinent to the maintenance functions.

B-3. Explanation of columns in section III.

a. *Reference Code, Column 1.* This column correlates to section II, column 4.

b. *Maintenance Level, Column 2.* This column identifies the maintenance levels using the tools and test equipment.

c. *Nomenclature, Column 3.* This column identifies the tools and test equipment.

d. *National Stock Number, Column 4.* This column provides the national stock number (NSN) of the specific tools or test equipment.

B-4. Explanation of columns in section IV.

a. *Reference Code, Column 1.* This column correlates to section II, column 5.

b. *Remarks, Column 2.* This column provides supplemental information or explanatory notes pertinent to the maintenance function in section II.

Section II. MAINTENANCE ALLOCATION CHART FOR THERMOMETER

(1) GROUP NO.	(2) ASSEMBLY GROUP	(3) MAINTENANCE FUNCTIONS											(4) TOOLS AND EQUIPMENT	(5) REMARKS
		A	B	C	D	E	F	G	H	I	J	K		
00	Thermometer	O 0.3	O 0.5	O 0.3				O 0.5	O 0.5	O 0.5	O 2.0	O 2.0	01,02,03	A
01	Housing	O 0.2							O 0.5				01,02	A
02	Display LCD Board	O 0.5	O 0.5						O 1.0				01,02,03, 05,06	A
03	Transformer T1	O 0.5	O 0.5						O 1.0				01,02,03, 05	A
04	Cable Flex 30 Cond.	O 0.5	O 0.5						O 1.0				01,02,03	A
05	Connector Probe J1	O 0.2	O 0.2						O 0.2				01,02,03	A
06	Switch, Slide S1, S2	O 0.2	O 0.2						O 0.5				01,02,03	A
07	Switch Probe S1	O 0.2	O 0.2						O 0.5				01,02,03	A
08	Switch S4, S5	O 0.2	O 0.2						O 0.5				01,02,03	A
09	Display PCB	O 1.5	O 1.5						O 1.0				01,02,03, 05,06	A
10	Microprocessor Board	O 1.5	O 1.5						O 1.0				01,02,03, 05,06	A

Section III. TOOLS AND TEST EQUIPMENT FOR THERMOMETER

(1) REFERENCE CODE	(2) MAINTENANCE LEVEL	(3) NOMENCLATURE	(4) NATIONAL STOCK NUMBER
01	O,F,H,D	Tool Kit, Medical Equipment Maintenance and Repair: Repairmans	5180-00-611-7923
02	O,F,H,D	Tool Kit, Medical Equipment Maintenance and Repair: Organizational	5180-00-611-7924
03	O,F,H,D	Multimeter, AN/USM 486 or Multimeter, AN/PSM 45A	6625-01-145-2430
04	O,F,H,D	Oscilloscope, AN/USM 488	6625-01-265-6000
05	O,F,H,D	Test Set, Circuit Component, TS 4138/P	6525-01-187-7847
06	O,F,H,D	Tester, Semiconductor, TS 1836 D/U	6625-01-255-0839
			6625-00-138-7320

**Section IV. REMARKS
FOR
THERMOMETER**

(1) REFERENCE CODE	(2) REMARKS
A	Tools and test equipment are listed for each assembly group.

APPENDIX C

COMPONENTS OF END ITEM AND BASIC ISSUE ITEMS LIST

Section I. INTRODUCTION

C-1. Scope.

This appendix lists components of end item and basic issue items for the equipment to help you inventory items required for safe and efficient operation.

C-2. General.

The Components of End Item and Basic Issue Items lists are divided into the following sections.

a. Section II. Components of End Item. These items are part of the end item, but are removed and separately packaged for transportation or shipment. As part of the end item, these items must be with the end item whenever it is issued or transferred between property accounts.

b. Section III. Basic Issue Items. These are the minimum essential items required to place the equipment in operation, to operate it, and to perform emergency repairs. Basic issue items must be with the equipment during operation and whenever it is transferred between property accounts. This manual is your authority to request or requisition basic issue items, based on MTOE authorization of the end item.

C-3. Explanation of columns.

The following provides an explanation of columns found in both listings:

a. Item Number, Column 1. This column indicates the item number assigned to the item.

b. National Stock Number, Column 2. This column indicates the national stock number assigned to the item.

c. Description, Column 3. This column indicates the federal item name and, if required, a minimum description to identify and locate the item. The last line for each item indicates the commercial and government entity (CAGE) code in parentheses followed by the part number.

d. Unit of Measure, Column 4. This column indicates the unit of measure used in performing the actual operational or maintenance function. This measure is expressed by a two-character alphabetical abbreviation. These abbreviations are listed in the glossary.

e. Quantity, Column 5. This column indicates the quantity (QTY) of the item(s) provided with the equipment.

Section II. COMPONENTS OF END ITEM FOR THERMOMETER

[illegible]

Section III. BASIC ISSUE ITEMS FOR THERMOMETER

[illegible]

APPENDIX D

EXPENDABLE AND DURABLE SUPPLIES AND MATERIALS LIST

Section I. INTRODUCTION

D-1. Scope.

This appendix lists expendable and durable supplies and materials that are required to maintain the equipment. This listing is authorization to requisition and retain the items if not otherwise authorized.

D-2. Explanation of columns.

- a. Item Number, Column 1.* The item number (Item No.) is sequentially assigned.
- b. Level, Column 2.* This column identifies the lowest level of maintenance that requires the listed item. An explanation of the alphabetical character is provided in appendix B, section I of this manual.
- c. National Stock Number, Column 3.* This column indicates the national stock number assigned to the item.
- d. Description, Column 4.* This column indicates the federal item name and, if required, a minimum description to identify and locate the item. The last line for each item indicates the CAGE code in parentheses followed by the part number.
- e. Unit of Measure, Column 5.* This column indicates the unit of measure used in performing the actual operational or maintenance function. This measure is expressed by a two-character alphabetical abbreviation. These abbreviations are listed in the glossary.
- f. Quantity, Column 6.* This column indicates the quantity (QTY) of the item(s) provided with the equipment.

Section II. EXPENDABLE AND DURABLE SUPPLIES AND MATERIALS LIST FOR THERMOMETER

[illegible]

APPENDIX E

REPAIR PARTS AND SPECIAL TOOLS LIST

Section I. INTRODUCTION

E-1. Scope.

This manual lists spare and repair parts, special tools, special test equipment; and other special support equipment required for the performance of unit level, direct support, general support, and depot level maintenance. It authorizes the requisitioning and issue of spare and repair parts in consonance with the MAC (app B).

E-2. General.

The Repair Parts and Special Tools List is divided into the following sections:

- a. *Repair Parts, Section II.* A list of repair parts authorized for the performance of maintenance in figure number and item number sequence.
- b. *Special Tools, Test, and Support Equipment, Section III.* A list of special tools, test, and support equipment authorized for the performance of maintenance.

E-3. Explanation of columns in section II.

a. *Illustration, Column 1.*

(1) *Figure Number.* This column indicates the figure number (Fig No.) of the illustration on which the item is shown.

(2) *Item Number.* This column indicates the item number (Item No.) used to identify each item on the illustration.

b. *National Stock Number, Column 2.* This column indicates the national stock number assigned to the item.

c. *Description, Column 3.* This column indicates the federal item name of the item. The last line for each item indicates the CAGE code in parentheses followed by the part number.

d. *Unit of Measure, Column 4.* This column indicates the unit of measure used in performing the actual operational or maintenance function. This measure is expressed by a two-character alphabetical abbreviation.

e. *Quantity, Column 5.* This column indicates the quantity (QTY) of the item(s) to be used with or on the illustrated component, assembly, module, or end item.

E-4. Explanation of columns in section III.

a. *Item Number, Column 1.* This number is sequentially assigned.

b. *Level, Column 2.* This column identifies the lowest level of maintenance that requires the listed item. An explanation of the alphabetical character is provided in appendix B, section I of this manual.

c. *National Stock Number, Column 3.* This column indicates the national stock number assigned to the item.

d. *Description, Column 4.* This column indicates the federal item name and, if required, a minimum description to identify and locate the item. The last line for each item indicates the CAGE code in parentheses followed by the part number.

e. *Unit of Measure, Column 5.* This column indicates the unit of measure used in performing the actual operational or maintenance function. This measure is expressed by a two-character alphabetical abbreviation.

f. *Quantity, Column 6.* This column indicates the quantity (QTY) of the item(s) to be used with or on the equipment.

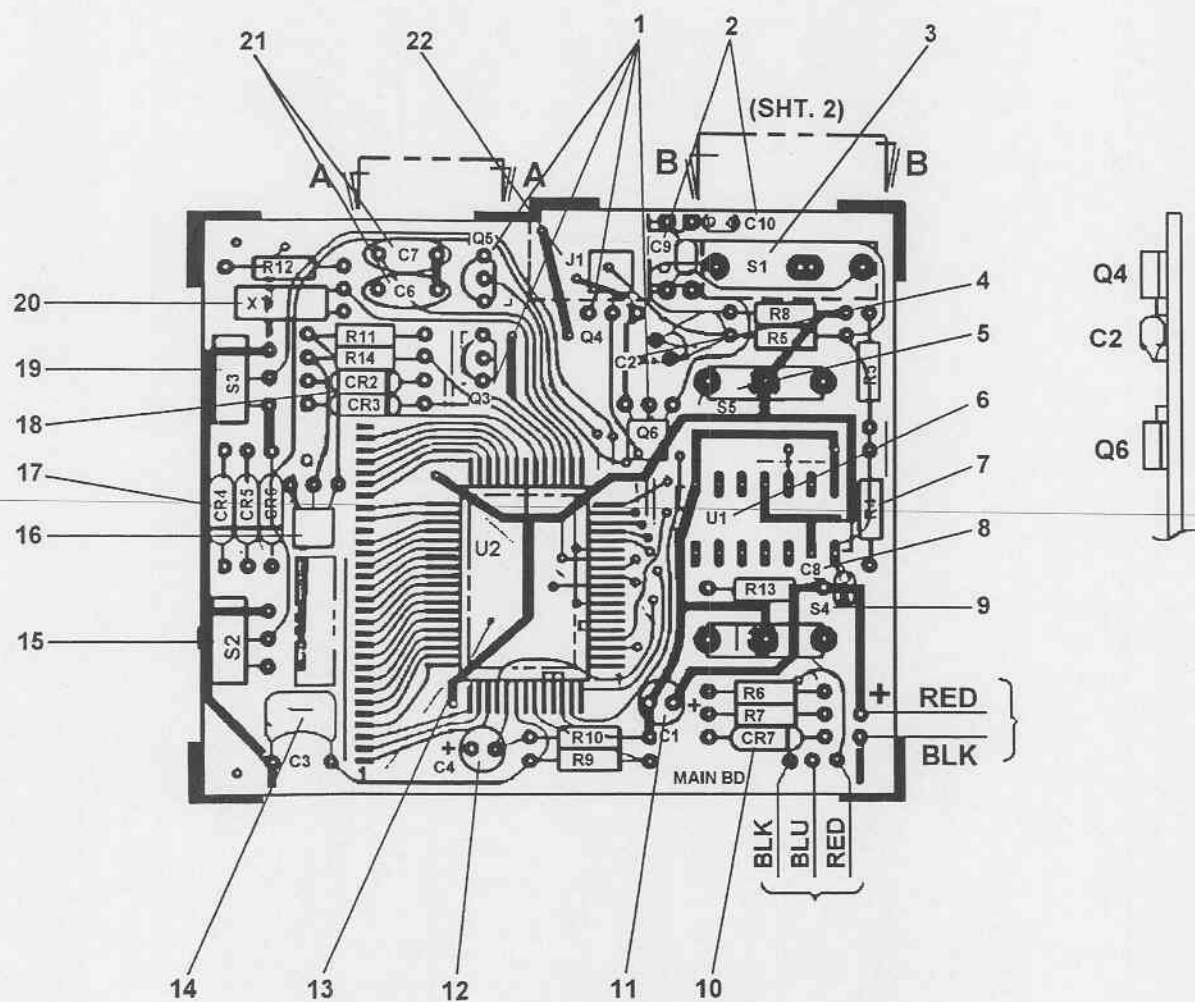


Figure E-1. PCB.

Section II. REPAIR PARTS LIST FOR THERMOMETER

(1) ILLUSTRATION		(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION	(4) UNIT OF MEASURE	(5) QTY
FIG NO.	ITEM NO.				
E-1	1		FET, Power, VN10KM, Q3-Q6 (58663) 50021-000	EA	1
E-1	2		Cap, .01uf/100V, C9, C10, Ceramic (58663) 46009-000	EA	1
E-1	3		Switch Probe, S1 (58663) 58101-000	EA	1
E-1	4		Cap 39mf, 6.4V/10%, C2, Tantalum (58663) 46098-000	EA	1
E-1	5		Switch, Contact, S5 (58663) 58096-000	EA	1
E-1	6		Monochip MDG-3242, U1 (58663) 54124-000	EA	1
E-1	7		Crystal, 32.768 KHz, X1 (58663) 47006-000	EA	1
E-1	8		Cap, .01uf/100V, C8, Ceramic (58663) 46009-000	EA	1
E-1	9		Switch, Contact, S4 (58663) 58096-000	EA	1
E-1	10		Diode, IN459, CR7 (58663) 44011-000	EA	1
E-1	11		Cap, 47uf/6.3V, 20%, C1 (58663) 46090-000	EA	1
E-1	12		Cap, .047uf/35V, TANT, C4 (58663) 46013-000	EA	1
E-1	13		Lamp Electro, DS2, Luminescent (58663) 58104-000	EA	1
E-1	14		Cap, 33uf/20%, Mica, C3 (58663) 46091-000	EA	1
E-1	15		Switch, Slide, S2 (58663) 58100-000	EA	1
E-1	16		Transistor, PN2222, Q7 (58663) 50004-000	EA	1
E-1	17		Diode, IN459, CR4 - CR6 (58663) 44011-000	EA	1
E-1	18		Diode, IN459, CR2 - CR3 (58663) 44011-000	EA	1

E-3/E-4 blank

Section II. REPAIR PARTS LIST FOR THERMOMETER

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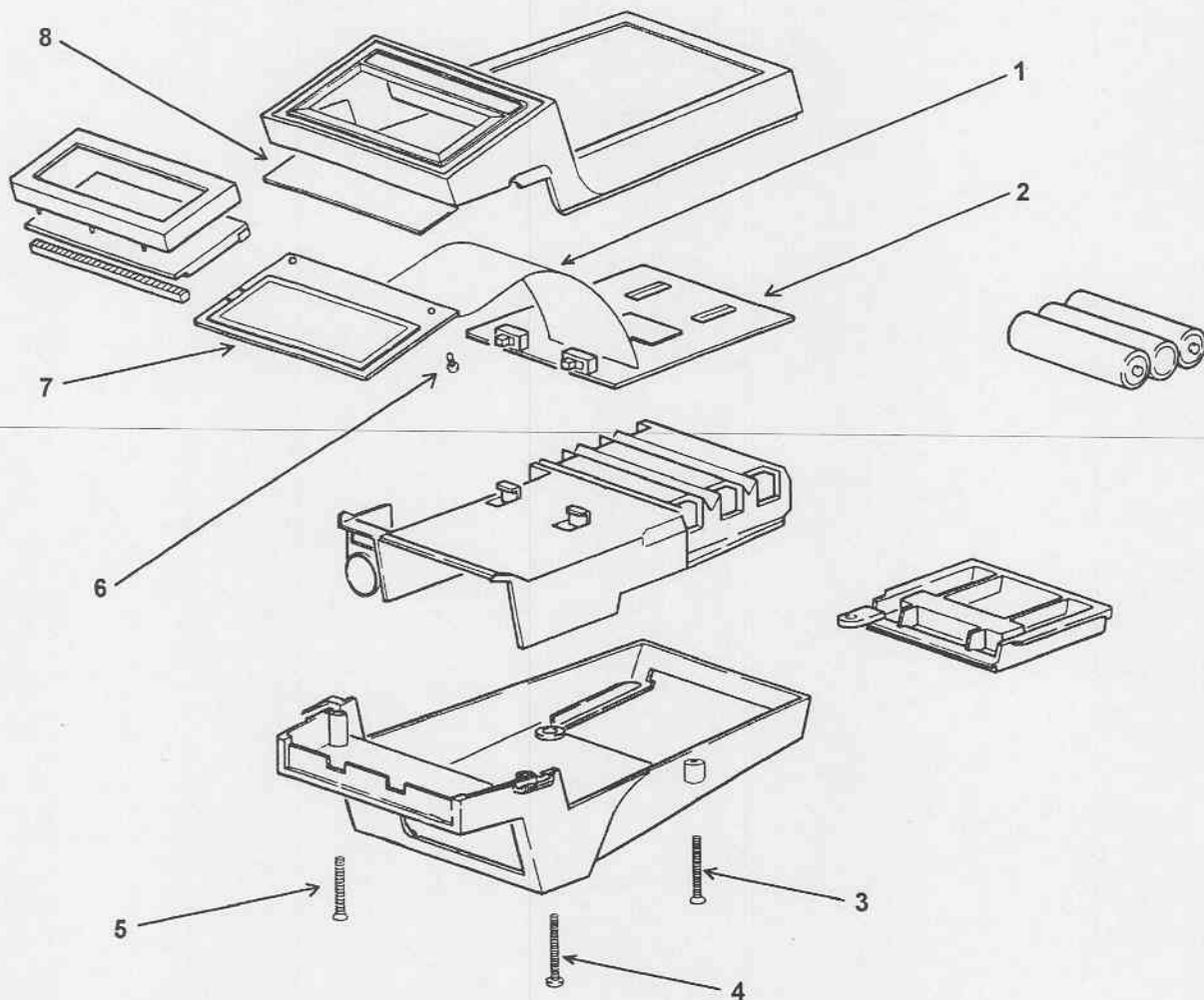


Figure E-2. Hand-held monitor.

Section II. REPAIR PARTS LIST FOR THERMOMETER

(1) ILLUSTRATION		(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION	(4) UNIT OF MEASURE	(5) QTY
FIG NO.	ITEM NO.				
E-2	1		Cable, Flex, 30, Conductor (58663) 58103-000	EA	1
E-2	2		PCB, Model 600, Thermometer (58663) 56030-000	EA	1
E-2	3		Screw, Self-Tap, 4 X 7/8 CSK, 82 Plastilock (58663) 83035-000	EA	1
E-2	4		Screw, Mach, 4-40 X 1-1/16 PHD (58663) 83036-000	EA	1
E-2	5		Screw, THD-roll, #4 X 3/4, Plastilock (58663) 83037-000	EA	2
E-2	6		Screw, THD-roll, #4 X 1/4, Plastilock (58663) 83021-000	EA	2
E-2	7		PCB, Display (58663) 56048-000	EA	1
E-2	8		Window, Display (58663) 25103	EA	1

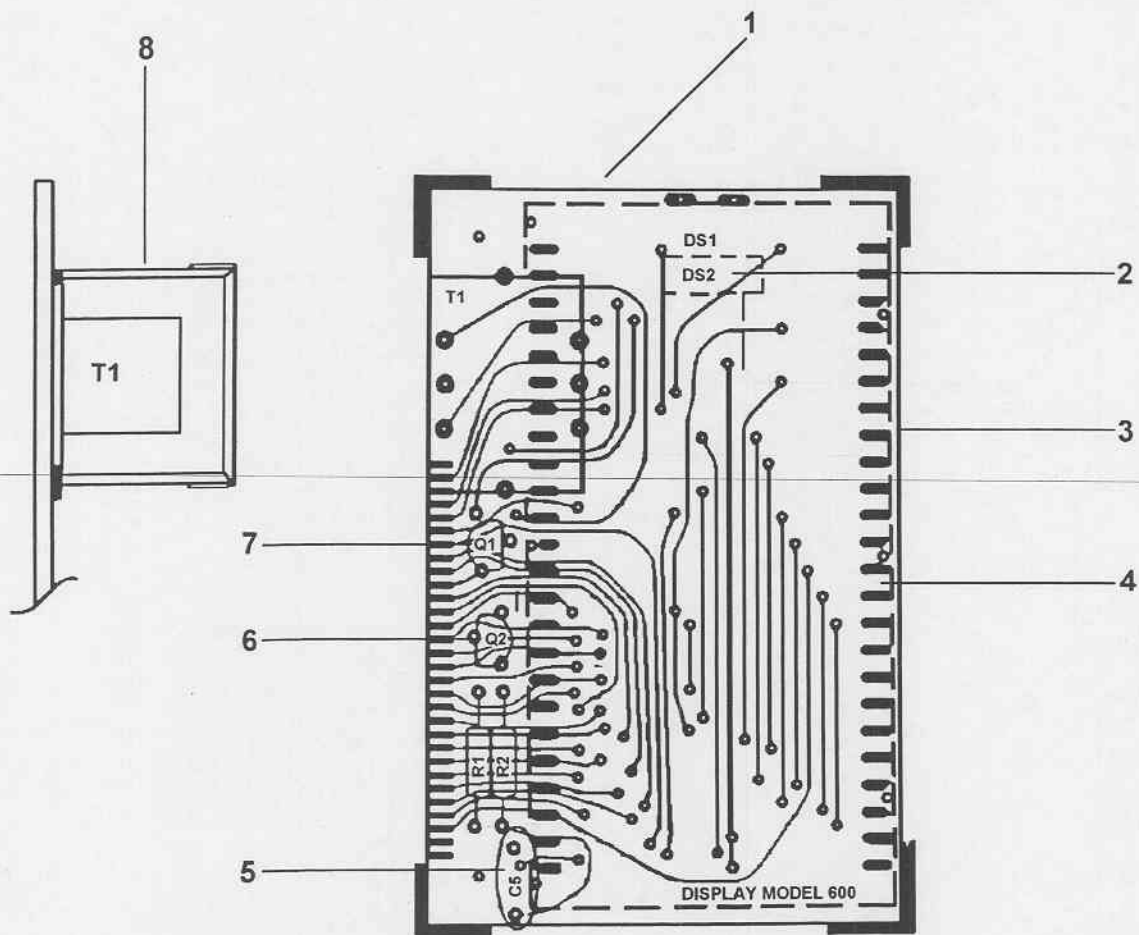


Figure E-3. LCD display.

Section II. REPAIR PARTS LIST FOR THERMOMETER

(1) ILLUSTRATION		(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION	(4) UNIT OF MEASURE	(5) QTY
FIG NO.	ITEM NO.				
E-3	1		LCD Display, DS1 (58663) 60011-000	EA	1
E-3	2		Lamp Electro, DS2, Luminescent (58663) 58104-000	EA	1
E-3	3		Zebra Frame (58663) 25092-000	EA	1
E-3	4		Zebra Strip (58663) 58112-000	EA	1
E-3	5		Cap, .01uf/100V, Ceramic, C5 (58663) 46094-000	EA	1
E-3	6		Transistor, PN2222, Q2 (58663) 50004-000	EA	1
E-3	7		Transistor, PN2222, Q1 (58663) 50004-000	EA	1
E-3	8		Transformer, T1 (58663) 52005-000	EA	1

Section III. SPECIAL TOOLS, TEST, AND SUPPORT EQUIPMENT FOR THERMOMETER

[illegible]

GLOSSARY

AFR	Air Force regulation
app	Appendix
AR	Army regulation
AR	As required
BX	Box
C	Operator or crew
CAGE	Commercial and government entity
cm	Centimeter
CN	Can
CVC	Calibration/verification/certification
D	Depot level maintenance
DA	Department of the Army
°C	Degrees Celsius
°F	Degrees Fahrenheit
DC	Direct current
DLAM	Defense Logistics Agency manual
DPSC	Defense Personnel Support Center (now DSCP)
DS	Direct support
EA	Each
ETO	Ethylene oxide
F	Direct support maintenance
FET	Field effect transistor
fig	Figure
FM	Field manual
FT(ft)	Foot (feet)
GS	General support
H	General support maintenance
hrs	Hours
Hz	Hertz (cycles per second)
in	Inch
Inc.	Incorporated
KHz	Kilohertz
LCD	Liquid crystal display
MAC	Maintenance allocation chart
mm	Millimeter
MPL	Mandatory parts list
MTOE	Modified table of organization and equipment
No.	Number
NSN	National stock number

O	Unit maintenance
oz	Ounce
para	Paragraph
PCB	Printed circuit board
PG	Package
PMCS	Preventive maintenance checks and services
QC	Quality control
QTY	Quantity
RO	Roll
RX	Reparable exchange
sec	Section
Ser. No.	Serial number
SB	Supply bulletin
TB	Technical bulletin
TDA	Table of distribution and allowances
TM	Technical manual

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